Urban NPS Measures

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## Typical Pollutant Loadings from Runoff by Urban Land Use (lbs/acre-yr)

<table>
<thead>
<tr>
<th>Land Use</th>
<th>TSS</th>
<th>Total P</th>
<th>TKN</th>
<th>NH₃-N</th>
<th>NO₂+NO₃ -N</th>
<th>BOD</th>
<th>COD</th>
<th>Pb</th>
<th>Zn</th>
<th>Cu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>1000</td>
<td>1.5</td>
<td>6.7</td>
<td>1.9</td>
<td>3.1</td>
<td>62</td>
<td>420</td>
<td>2.7</td>
<td>2.1</td>
<td>0.4</td>
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<tr>
<td>Parking Lot</td>
<td>400</td>
<td>0.7</td>
<td>5.1</td>
<td>2</td>
<td>2.9</td>
<td>47</td>
<td>270</td>
<td>0.8</td>
<td>0.8</td>
<td>.04</td>
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<tr>
<td>High Density Residential</td>
<td>420</td>
<td>1</td>
<td>4.2</td>
<td>0.8</td>
<td>2</td>
<td>27</td>
<td>170</td>
<td>0.8</td>
<td>0.7</td>
<td>.03</td>
</tr>
<tr>
<td>Med Density Residential</td>
<td>190</td>
<td>0.5</td>
<td>2.5</td>
<td>0.5</td>
<td>1.4</td>
<td>13</td>
<td>72</td>
<td>0.2</td>
<td>0.2</td>
<td>.14</td>
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<tr>
<td>Low Density Residential</td>
<td>10</td>
<td>0.04</td>
<td>.03</td>
<td>0.02</td>
<td>0.1</td>
<td>NA</td>
<td>NA</td>
<td>.01</td>
<td>.04</td>
<td>.01</td>
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<tr>
<td>Freeway</td>
<td>880</td>
<td>0.9</td>
<td>7.9</td>
<td>1.5</td>
<td>4.2</td>
<td>NA</td>
<td>NA</td>
<td>4.5</td>
<td>2.1</td>
<td>.37</td>
</tr>
<tr>
<td>Industrial</td>
<td>860</td>
<td>1.3</td>
<td>3.8</td>
<td>0.2</td>
<td>1.3</td>
<td>NA</td>
<td>NA</td>
<td>2.4</td>
<td>7.3</td>
<td>0.5</td>
</tr>
<tr>
<td>Park</td>
<td>3</td>
<td>0.03</td>
<td>1.5</td>
<td>NA</td>
<td>0.3</td>
<td>NA</td>
<td>2</td>
<td>0</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Construction</td>
<td>6000</td>
<td>80</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

NURP Study: Homer et al, 1994
Imperviousness vs. Runoff

Natural Ground Cover

- 25% Shallow Infiltration
- 25% Deep Infiltration
- 10% Runoff
- 40% Evapotranspiration

10% - 20% Impervious Surface

- 21% Shallow Infiltration
- 21% Deep Infiltration
- 20% Runoff
- 38% Evapotranspiration

75% - 100% Impervious Surface

- 10% Shallow Infiltration
- 5% Deep Infiltration
- 55% Runoff
- 30% Evapotranspiration

Changes in runoff flow resulting from increased impervious area (NC Dept. of Nat. Res. and Community Dev., in Livingston and McCarron, 1992.)
Generalized Relationship Between Impervious Cover and Stream Quality

Watershed Impervious Cover

10% 25% 40% 60% 100%

Good
Fair
Poor

Impervious Cover Model

Sensitive
Impacted
Urban Drainage
Non-Supporting

Center for Watershed Protection
Consequences of Development to Urban Streams

- Large Storm
  - Higher Baseflow
  - More Runoff Volume
  - Lower and Less Rapid Peak Discharge
  - Gradual Recession

- Small Storm
  - Lower Baseflow
  - More Runoff Volume
  - Lower and Less Rapid Peak Discharge
  - Gradual Recession

Pre-development

Post-development
Land Use Planning is the First BMP!
Lincoln, Nebraska
Wide buffers along major drainageways, master planning entire city, comprehensive drainage criteria manual
Green Infrastructure
Low Impact Development
Curbless Streets
• Green Roof
  – Villanova Funded
• Comments
  – Water – first two years?
  – Fertilize?
  – Higher storms “Dirtier”
  – Roof Life
  – Energy
  – Structural Strength
Rain Gardens
Capture and Reuse

- Can save money
- High initial investment
- Have to USE WATER~!

- Nursery
- Golf course
- Car wash
- Sprinkler System

http://www.forgottenrain.com/photo_06.htm
Porous Landscape Detention
Permeable Pavements
• **Pervious Concrete Demonstration Site**
  – Retrofit of existing Paved Area
  – Designed for Higher Vol. Infiltration

• **Comments**
  – Roof water clean
  – LARGE bottom area
  – Pervious Concrete—filter (So need vacuum!)
  – Replacement DIFFICULT
Bioretention

• Pros
  – Generally high volume reduction (groundwater recharge) (+/- 90%)
  – Generally high pollutant removal
  – Performance improved without underdrains or when using BMPs in series
  – Routine maintenance may be lower – no mowing
  – Possible related savings via reduction in “grey” infrastructure

• Cons
  – Small size means more BMPs to track and maintain
  – Best design specs uncertain at present
  – Maintenance issues with private land owners
  – Higher construction costs per impervious acre

Construction cost/ impervious acre = $25,000 (CWP)
Infiltration potential - +/- 90%
• **Bioinfiltration Traffic Island**
  – (PA Growing Greener Grant -2001)
  – Retrofit of existing Traffic Island
  – Watershed – 1.1 Acres 40%
  – Headwaters – Darby River
  – EPA National Monitoring Program

• **Comments**
  – Self sustaining
  – Low volume design effective
  – TSS - Surface Layer
  – DS? Nutrients - not so clear
    • Chlorides straight through
  – Maintenance?
• **Infiltration Trench – (319 Grant ‘04)**

• **Retrofit – Parking Deck**
  – Designed for .25” (first flush)

• **Comments**
  – Need Pretreatment
    • Manufactured devices?
  – Infiltrate sides (bottom seals)
  – Replacement? Difficult
Wet Ponds and Created Wetlands
Wet Ponds

• Pros
  – Pollutant removal generally good
  – Peak flow control
  – Can be community assets
  – Can be (re)designed to include trees, wetland plants, etc. Could also lower some maintenance costs

• Cons
  – Little volume reduction ( +/- 10% )
  – Potential outflow impacts on stream channel
  – Increases water temp
  – Traditional designs offer little habitat value
  – Design may lead to high maintenance costs

Construction cost per impervious acre = $8,350 (CWP)
Infiltration Capacity +/- 10%
• **Stormwater Wetland**
  – (319 Grant – 1998)
  – Retrofit of a detention pond
  – Watershed - 41 Acres – 39% paved

• **Comments**
  – REMEMBER – NEED WATER!
  – Storage BETWEEN storm events
  – Harvesting?
  – Sediment Forebay?
  – Temperature?
Wetland Swales
Dry Ponds
Dry Pond

• Pros
  – Can be multiple use areas, such as ball fields
  – Reduce “peak” flow impacts
  – Often unrecognized, moderate infiltration capacity

• Cons
  – Generally not very effective at pollutant removal
  – Infiltration capacity moderate to low
  – Maintenance cost can be high due to frequent mowing and trash removal

Construction cost per impervious acre = $3,800 (CWP)
Infiltration Capacity +/- 20%-30%
National Management Measures to Control Nonpoint Source Pollution from Urban Areas
Past Practices

Flooding Based
Peak Flow Focus
Large Long storms
Detention Focused
• 111 detention basins
• Functioning as designed?
• Additive effects?

Valley Creek, PA

Clay Emerson
• 111 detention basins surveyed, including outflow devices
• 6 recording rain gauges installed
• Soils, infiltration, basin, rainfall data incorporated into model
• Predictions of storm runoff with and without basins quantified

2.0 inch rainfall
Peak without basins: 117 cfs
Peak with basins: 114 cfs

• Basins are designed for 2 - 100 yr storms
• Basins have no effect on small storms (here ≤ 1 yr)
• 97% of our rainfall falls as small storms
• Need for revising design criteria

Emerson, Welty, and Traver, ASCE J Hydrologic Eng.
When selecting BMPs, know your watershed

- Water Quality Standards/Designated Uses
- Existing impacts (impairments and TMDLs)
- Social setting (public acceptance)
- Ordinances/regulations
  - Required practices
  - Enforcement mechanism
- Drainage and flooding issues
- Future conditions
Recommendations for BMP Designers

• Use a treatment train approach for BMPs that considers:
  – The pollutants of concern and their form
  – The BMPs that can effectively address these pollutants
  – The volume reduction potential of the BMPs

• Using a treatment train will help to account for the inherent variability and uncertainties that are associated with BMP performance

• Use performance data to help improve designs
Recommendations for Designers (con’t)

• Design BMPs for better performance than “average” or “median.” The upper 75% quartile makes a good target

• Use conservative criteria, including sizing and focusing on longer residence times for volume based BMPs, as well as larger sizing of filters and other flow-through BMPs

• Accomplish multiple benefits in accordance with goals
Other Considerations for BMP Selection

Beyond pollutant and volume reduction potential, we need to consider:

• Costs
  – Capital costs
  – Costs per acre treated
  – Maintenance costs

• Maintenance
  – Frequency of needed maintenance
  – Ease of maintenance, access

• Function in regional drainage/flood mgt.

• Secondary benefits, such as habitat, carbon sequestration, water conservation, etc.

• Safety
• Aesthetics
• Longevity/useful life
Moving Beyond Site-Level Planning

- Successful local post-construction stormwater programs will need to actively engage at multiple scales to protect and restore watersheds
  - Regional/Watershed
  - Neighborhood
  - Site
Identification of stressors

- Where causes of biological impairment are unknown, use characterization data to help identify stressors.

USEPA Stressor Identification Guidance Document
www.epa.gov/waterscience/biocriteria/stressors/stressors.htm

USEPA Causal Analysis/Diagnosis Decision Information System (CADDIS) http://cfpub.epa.gov/caddis/home.cfm
Flashiness Index

• Frequency and rapidity of short term changes in streamflow
• Increased flashiness has been linked to lower biological scores
• Focus on matching flashiness to more natural flow regimes

Figure 8. Time Trends in R-B Index Values for Six Streams in Ohio and Michigan for 1975 Through 2001. All streams have increasing trends that are significant at the 95 percent level (p < 0.05).

Source: Baker et al., 2004
Infiltrating Rainfall Can Result in Dramatic Pollutant Reductions

Worcester, MA – Rainfall events 1948-2004

90% Storm event = 1.25 inches

In Worcester, infiltrating the first 1.25” = 90% of the total stormwater volume
Burnsville, Minnesota

Pre-Construction Runoff Data
June 6, 2003
0.50" Rainfall

Post-Construction Runoff Data
May 29, 2004
0.71" Rainfall
Importance of Volume Reduction

• Urban and suburban development are driving increasing impervious surfaces in our watersheds
  – Changing the hydrology of systems, especially smaller and medium-sized creeks, streams, and rivers
  – Increased streambank erosion, down cutting, channelization, loss of habitat, temperature
  – Decreases in baseflow and groundwater recharge (in many areas)
Volume Reduction (con’t)

- Volume (and velocity) reduction is important for its impact on the physical and biological aspects of streams.
- Volume reduction also plays an important part in pollutant reduction…
Total Load Reduction

In this example, the BMP removes 50 kg or 50% of the “total load” of this pollutant. It does not reduce the volume of stormwater discharged.
Impact of Volume Reduction on Total Load

In this example, the BMP removes 75 kg or 75% of the “total load” of this pollutant. The “true” performance of this BMP is only apparent when we factor in the impact of volume reduction and calculate the total load of the pollutant.
Who Needs BMP Information?

Clearly someone needs BMP information! The design drawings showed the location of the straw bales as a “dashed” line… hum…
BMP Performance is Variable

Variability in Removal of TSS
(median and 95% confidence intervals)

Source: International BMP Database
The Basics of BMP Performance

• Understanding BMP Performance
  – Factors influencing performance
  – Key terminology
  – Pollutant removal
    • Why “percent removal” is not a good indicator
  – The importance of volume reduction
    • Impact on stream systems
    • Relationship to pollutant removal
Factors Influencing BMP Performance

• BMPs are not static systems that deliver constant or even “predictable” results
• Performance is highly variable and impacted by:
  – Design
  – Soil type
  – Rainfall patterns
  – Land uses in the drainage area
  – Age of system
  – etc.
Controlling Bacterial Present
Real Challenges

Figure 2. Comparison of Geometric Mean E. coli Data for Stormwater BMPs in International Stormwater BMP Database

Recreation Primary Contact
Std = 126/100 mL
Welcome to the International Stormwater Best Management Practices (BMP) Database project website, which features a database of over 300 BMP studies, performance analysis results, tools for use in BMP performance studies, monitoring guidance and other study-related publications. The overall purpose of the project is to provide scientifically sound information to improve the design, selection and performance of BMPs. Continued population of the database and assessment of its data will ultimately lead to a better understanding of factors influencing BMP performance and help to promote improvements in BMP design, selection and implementation.

The project, which began in 1996 under a cooperative agreement between the American Society of Civil Engineers (ASCE) and the U.S. Environmental Protection Agency (USEPA), now has support and funding from a broad coalition of partners including the Water Environment Research Foundation (WERF), ASCE, Environmental and Water Resources Institute (EWRI), USEPA, Federal Highway Administration (FHWA) and the American Public Works Association (APWA). Wright Water Engineers, Inc. and Geosyntec Consultants are the entities maintaining and operating the database clearinghouse and web page, answering questions, conducting analyses of newly submitted BMP data, conducting updated performance evaluations of the overall data set, disseminating project findings, and expanding the database to include other approaches such as Low Impact Development techniques. The database itself is downloadable to any individual or organization that would like to conduct its own assessments.

What Type of User Are You? Let us help you enter our website to find the level of detail you need:

Low-Intenity
Get Basic Performance Summary Information for BMPs
Typical Users: Public officials, casual users, those seeking quick/fixed answers

Mid-Intenity
Get Detailed Statistical Analysis for Individual BMPs
Typical Users: Consultants, Public Works Staff, Designers

Researcher
Download the Master Database to Conduct Independent Research
Typical Users: University Professors, university researchers

Data Provider
Obtain Data Entry Spreadsheets
Typical Users: Public agencies, consulting firms, university researchers

New to BMP Monitoring
Obtain Monitoring Guidance
Typical Users: Public agencies, consulting firms, university researchers

Jonathan Jones, PE – D.WRE.
Wright Water Engineers
Co-Project Team Leader for International BMP Database
Features of the International BMP Database

- Key resource for researchers
- Information on 300+ studies
- Summaries of BMP Performance
- Monitoring and Evaluation Guidance
- Publications and Papers
- Statistical abstracts for many studies

www.bmpdatabase.org
National Pollutant Removal Performance Database

National Pollutant Removal Performance Database
Version 3
September, 2007

The National Pollutant Removal Performance Database v. 2 was recently updated to include an additional 27 studies published through 2006. The updated database was statistically analyzed to derive the median and quartile removal values for each major group of stormwater BMPs. The data are presented as box and whisker plots for the various pollutants found in stormwater runoff.
National Pollutant Removal Performance Database

• Project started in 2000
• Updated recently (NPRPD v.3, 2007)
• Now includes 166 studies published through 2006
• Visual summary of BMP performance, guidance on the use of BMP performance data
• Will continue to update and improve

www.cwp.org

Download report at:
www.cwp.org/PublicationsStore/special.htm
(free)
Example “Box and Whiskers” plot

Parameter and Number of studies:
- TSS: n=44
- TP: n=45
- Sol P: n=28
- TN: n=22
- NOx: n=29
- Cu: n=23
- Zn: n=34
- Bacteria: n=11
Wet Pond Performance

### Median concentrations, International BMP Database (n=25)

<table>
<thead>
<tr>
<th></th>
<th>TSS</th>
<th>TP</th>
<th>DP</th>
<th>TN</th>
<th>NO₃</th>
<th>Cu</th>
<th>Zn</th>
<th>Bacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>mg/L</td>
<td>ug/L</td>
<td>ug/L</td>
<td></td>
</tr>
<tr>
<td>Median</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Influent</td>
<td>37.73</td>
<td>0.21</td>
<td>0.09</td>
<td>1.64</td>
<td>0.38</td>
<td>9.84</td>
<td>60.75</td>
<td>na</td>
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<tr>
<td>Median</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effluent</td>
<td>9.74</td>
<td>0.1</td>
<td>0.05</td>
<td>1.31</td>
<td>~0.1</td>
<td>5.82</td>
<td>21.58</td>
<td>na</td>
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</tbody>
</table>
## Dry Pond Performance

### Median concentrations, International BMP Database (n =25)

<table>
<thead>
<tr>
<th></th>
<th>TSS</th>
<th>TP</th>
<th>DP</th>
<th>TN</th>
<th>NO$_3$</th>
<th>Cu</th>
<th>Zn</th>
<th>Bacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Influent</td>
<td>72.64</td>
<td>0.19</td>
<td>0.09</td>
<td>1.25</td>
<td>0.7</td>
<td>20.13</td>
<td>111.56</td>
<td>na</td>
</tr>
<tr>
<td>Median Effluent</td>
<td>26.74</td>
<td>0.19</td>
<td>0.09</td>
<td>2.22</td>
<td>0.48</td>
<td>15.91</td>
<td>58.66</td>
<td>na</td>
</tr>
</tbody>
</table>

---

### Dry Pond Removal Efficiencies

![Graph showing removal efficiencies of various parameters like TSS, TP, DP, TN, NO$_3$, Cu, Zn, and Bacteria.]

- **TSS**: Median Influent = 72.64 mg/L, Median Effluent = 26.74 mg/L
- **TP**: Median Influent = 0.19 mg/L, Median Effluent = 0.19 mg/L
- **DP**: Median Influent = 0.09 mg/L, Median Effluent = 0.09 mg/L
- **TN**: Median Influent = 1.25 mg/L, Median Effluent = 2.22 mg/L
- **NO$_3$**: Median Influent = 0.7 ug/L, Median Effluent = 0.48 ug/L
- **Cu**: Median Influent = 20.13 ug/L, Median Effluent = 15.91 ug/L
- **Zn**: Median Influent = 111.56 ug/L, Median Effluent = 58.66 ug/L
- **Bacteria**: Median Influent = na, Median Effluent = na
Summary of Removal Efficiencies for Conventional Detention and Biofiltration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Dry Detention Basins</th>
<th>Biofiltration Basins</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSS</td>
<td>70% - 90%</td>
<td>90%</td>
</tr>
<tr>
<td>TP</td>
<td>10% - 60%</td>
<td>70% - 83%</td>
</tr>
<tr>
<td>TKN</td>
<td>20% - 60%</td>
<td>68% - 80%</td>
</tr>
<tr>
<td>BOD</td>
<td>30% - 40%</td>
<td>60% - 80%</td>
</tr>
<tr>
<td>Lead</td>
<td>20% - 60%</td>
<td>93% - 98%</td>
</tr>
<tr>
<td>Zinc</td>
<td>40% - 60%</td>
<td>93% - 98%</td>
</tr>
<tr>
<td>TPHC</td>
<td>60% - 77%</td>
<td>90%</td>
</tr>
</tbody>
</table>
Figure 1: Logic Model. Low Impact Development (LID) channel stability example integrating modeling and monitoring (green) activities. Modeling (red) is used to help define critical areas and estimate how long until medium and long-term outcomes can be obtained. The monitoring (blue) strategy for sediment and flow strategy is based upon the model predictions.
Figure 2. Current Monitoring Stations

- Oaketum
- Waterfall
- Deadwood swamp
- Cascade
- Spreading ditch and Floodplain forest
- Sand/Peat Filter
- Riffle
- Shallow pond
- Detention ponds and Island habitat
- Recirculation pipes and pump
- Grit chamber
- Sampling stations
- Overflow
- From Groesbeck neighborhood
- To Groesbeck Golf Course
Check it out at: www.epa.gov/npdes/menuofbmps
National Pollutant Discharge Elimination System (NPDES)

NPDES Urban BMP Performance Tool

BMP Study Search

This tool was developed to help stormwater managers identify Best Management Practices (BMPs) appropriate for the individual needs and natural conditions of specific sites. Academics and government agencies have conducted hundreds of scientific studies measuring the effectiveness of various BMPs in managing stormwater. This tool will help stormwater managers access these studies and the conclusions they offer.

You can search for BMP performance studies in four different ways. Click on the radio button to search studies by pollutant, BMP, or volume reduction. Use the search box at the bottom of this page to search by keyword.

Search Studies by Pollutant, BMP, or Volume Reduction

- Search studies by the pollutants that were measured:
- Search studies by the BMP examined:
- Search studies by the total volume of stormwater runoff reduced by a BMP:

View Results  Reset
Search Studies by Pollutant, BMP, or Volume Reduction

- Search studies by the pollutants that were measured:

- Search studies by the BMP examined:
  Select a BMP from the drop down menu. To find studies measuring the BMP's effect on certain pollutants, select the primary pollutant group, then the primary pollutant measurement technique. Hold down the Ctrl key to select multiple pollutant measurement techniques. You can further refine your results by selecting a secondary pollutant group and a secondary pollutant measurement technique.

  BMP: 
  Primary Pollutant Group: NITROGEN 
  Primary Pollutant Measurement Techniques: All 
  Secondary Pollutant Group: 
  Secondary Pollutant Measurement Techniques: 

- Search studies by the total volume of stormwater runoff reduced by a BMP:

  View Results  Reset
<table>
<thead>
<tr>
<th>Reference Title</th>
<th>BMP Comment</th>
<th>Influent Concentration</th>
<th>Effluent Concentration</th>
<th>Other Reported Measures of Performance</th>
<th>Percent Volume Reduction</th>
<th>Quality of Study</th>
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</thead>
<tbody>
<tr>
<td>St. Johns River Water Management District: DeBary Detention with Filtration Pond</td>
<td>DeBary Detention with Filtration Pond</td>
<td>0.81</td>
<td>0.7</td>
<td></td>
<td>-91%</td>
<td>✅ ✅ ✅</td>
</tr>
<tr>
<td>Legislative Commission on Minnesota Resources: McKnight Basin Detention Pond</td>
<td>McKnight Basin Detention Pond</td>
<td>2.09</td>
<td>1.56</td>
<td></td>
<td>-11%</td>
<td>✅ ✅ ✅</td>
</tr>
<tr>
<td>Cherts, G. and Cs隔离, R. 1988, The effectiveness of a detention/wetland treatment system and its effect on an</td>
<td>Lake McCarran</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
BMP Information

BMP Site Name: Lake Munson
BMP Comment: Lake Munson
BMP also known as: Not Available
Description: Retention Pond (Wet) - Surface Pond With a Permanent Pool
Link to BMP Summary: http://nswbmp.geosyntec.com/pdfs/1204551109.pdf
Link to Statistical Summary: http://nswbmp.geosyntec.com/pdfs/1204551109d.pdf
Link to Menu of BMPs: http://c/pub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

Study BMP Specification

<table>
<thead>
<tr>
<th>Name</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent Pool Surface Area</td>
<td>103.2 Hectares</td>
</tr>
<tr>
<td>Volume of Permanent Pool</td>
<td>1258151.5 Cubic Meters</td>
</tr>
</tbody>
</table>

Pollutants

<table>
<thead>
<tr>
<th>Name</th>
<th>Inflow Concentration</th>
<th>Outflow Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALKALINITY, FIXED ENDPOINT (MG/L)</td>
<td>37.05</td>
<td>26.31</td>
</tr>
<tr>
<td>BOD-5 (MG/L)</td>
<td>10.15</td>
<td>5.87</td>
</tr>
<tr>
<td>CARBON, TOTAL ORGANIC (MG/L AS C)</td>
<td>29.92</td>
<td>16.73</td>
</tr>
<tr>
<td>CHLORIDE, TOTAL (MG/L)</td>
<td>8.96</td>
<td>9.8</td>
</tr>
<tr>
<td>CHROMIUM, TOTAL (UG/L AS CR)</td>
<td>4.77</td>
<td>0.43</td>
</tr>
<tr>
<td>COD (MG/L)</td>
<td>51.19</td>
<td>31.37</td>
</tr>
<tr>
<td>COPPER, TOTAL (UG/L AS Cu)</td>
<td>62.49</td>
<td>6.72</td>
</tr>
</tbody>
</table>
Storm Water Program

OVERVIEW

Storm water discharges are generated by runoff from land and impervious areas such as paved streets, parking lots, and building rooftops during rainfall and snow events that often contain pollutants in quantities that could adversely affect water quality. Most storm water discharges are considered point sources and require coverage by an NPDES permit. The primary method to control storm water discharges is through the use of best management practices.

WHAT CAN I FIND ON THIS WEB SITE?

This page contains technical and regulatory information about the NPDES storm water program. It is organized according to the three types of regulated storm water discharges and provides a link to Stormwater Month outreach materials:

- Construction activities
- Industrial activities
- Municipal separate storm sewer systems
- Stormwater Month Outreach Materials and Reference Documents

Information specific to the Phase I and Phase II storm water regulations is also available.

New! Factsheet: Stormwater Discharges Regulated as Class V Wells [PDF format] - This new fact sheet describes the conditions under which a stormwater discharge can be regulated as a Class V well and the steps required to implement a de minimis approach to stormwater management at that site.
NPDES Stormwater Permits

Stormwater Permit Requirements apply to:
• Construction Activities
• Sites where there are Industrial Activities
• Municipal Separate Storm Sewer Systems (MS4s)

Goals for MS4 Stormwater Management Programs:
• Reduce the discharge of pollutants to the “maximum extent practicable” (MEP)
  – implementation of BMPs
  – achievement of measurable goals
• Protect water quality
• Satisfy the appropriate water quality requirements of the Clean Water Act
Program Elements for Phase II MS4 Communities

Minimum Control Measures

1. **Public Education and Outreach**
2. **Public Participation/Involvement**
3. **Illicit Discharge Detection and Elimination**
4. **Construction Site Runoff Control**
   - Minimize erosion, control sediment and other pollutants
5. **Post-Construction Runoff Control**
   - Addresses discharges of post-construction stormwater runoff from new development and redevelopment areas
   - Example BMPs: protecting sensitive areas (e.g., wetlands), LID and other green strategies
6. **Pollution Prevention/Good Housekeeping**
   - A program to prevent or reduce pollutant runoff from municipal operations
   - Includes training on pollution prevention measures and techniques (e.g., street sweeping, reduction in the use of pesticides and street salt, catch-basin cleaning)
Phase II MS4 Program Assessment

- Initial round of permits focused on getting MS4 Stormwater Programs established
- Now focus is turning to implementation, and evaluation of effectiveness
- Monitoring is not specifically required in most MS4 permits
  - But...NPDES authority can require monitoring
- An inspection and monitoring program can be an important part of evaluating MS4 program effectiveness
- Monitoring/Evaluation Elements:
  - Inspect and assess effectiveness of BMPs
    - Determine if BMPs are reducing the discharge of pollutants from their systems to the “maximum extent practicable”
    - Determine if the BMP mix is satisfying the water quality requirements of the Clean Water Act
  - Assess progress in achieving SMP measurable goals
  - If insufficient progress, revise mix of BMPs
Resource

Visit EPA’s Green Infrastructure Website
http://www.epa.gov/npdes/greeninfrastructure
Sign Up for NPDES News

• Periodic news updates from the NPDES Permit Program
• Information on the latest NPDES guidance, training and tools

www.epa.gov/npdes and click on:
Stormwater and TMDL References

• Summary of 17 TMDLs with Stormwater Sources
  www.epa.gov/owow/tmdl/17_TMDLs_Stormwater_Sources.pdf

• Total Maximum Daily Loads and National Pollutant Discharge Elimination System Storm Water Permits for Impaired Water Bodies: A Summary of State Practices
  www.epa.gov/region5/water/wshednps/topic_tmdls.htm

• Forth coming guidance on stormwater/TMDLs for permit writers and TMDL developers